



STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES &
ENVIRONMENTAL CONTROL
DIVISION OF WATER
89 KINGS HIGHWAY
DOVER, DELAWARE 19901

**Response to Public Comments Submitted to DNREC Regarding the
Wandendale Application to Construct a 1.45 Million Gallon per Day (MGD)
On-Site Wastewater Treatment and Disposal System**

The Department's Division of Water, Ground Water Discharge Section (GWDS), submits the following general clarifications to some of the technical questions raised by written comments GWDS received prior to the August 31, 2011 Wandendale public hearing. This document clarifies the issues raised in the comments, but does not purport to reflect any decision on the pending permit application, which will be made by the Secretary of the Department after consideration of the comments made at the public hearing. The Department has preliminarily accepted certain studies submitted by the Applicant for its application, but the Department reserves the right to change its preliminary acceptance based upon information received at the public hearing.

Commenter's Statement: *"Statements in the technical response indicate that at least 10% of the discharge would be to Burton Prong along Shaw Run."*

Department's Response: The statement is accurate (except correcting *Shaw Run* to *Sarah Run*). The September 2009 Preliminary Groundwater Impact Assessment (PGIA) shows that the flow paths [are] semi-radial, with the majority of the flow being to the east, southeast, and south. Most flows paths are very long; with travel times ranging 15 to 35 years. On the west side of RIB Area A, approximately ten percent of the flow will follow a shorter path of approximately two years, but only after flows to the RIBs reaches approximately 1.2 MGD.

Commenter's Statement: *"The record contains various claims as to the time it will take the discharge to reach surface waters. TESI claims 15-35 years. DNREC hydrogeologists give a range of 5 to 15 years to as little as 2 years (Strohmeier, 7/16/10)."*

Department's Response: Please see the Department's Response above. Additionally, a Groundwater Protection Branch (GPB) memorandum dated 1/12/10 stated, "EGI performed a "fate and transport" evaluation. The results of

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the evaluation indicate >80% dilution along the shortest flow path and >90% within a 5-year time of travel and within 2,000 ft of RIB Area A. Shorter flow paths towards Sarah Run exist to the west with travel times of 2 years or less. EGI indicated that these shorter flow paths will not emerge until the system is near full capacity."

Commenter's Statement: *"The Inland Bays PCS fact sheet gives the hydraulic conductivity of the areas 80 ft/day and in the range of 1-270 ft/day for the Columbia aquifer. This would indicate that discharge could occur in days without any significant dilution."*

Department's Response: Although the referenced hydraulic conductivity values are in units of ft/day, the values do not translate directly to groundwater-flow velocities. Travel-time determinations for groundwater systems require a calculation of seepage velocity, or average linear velocity. Average linear velocity is not just a function of hydraulic conductivity, but also a function of hydraulic gradient and effective porosity as indicated by the following equation:

$$V_x = \frac{Q}{n_e A} = - \frac{K dh}{n_e dl} \quad (\text{Fetter, 2001})$$

where

- V_x is average linear velocity (L/T)
- Q is discharge (L^3/T)
- n_e is effective porosity (dimensionless)
- A is cross-sectional area (L^2)
- K is hydraulic conductivity (L/T)
- dh/dl is hydraulic gradient (dimensionless)

The groundwater-flow model used by EGI took all of these parameters into account, which yielded a much longer travel time to surface water than the commenter stated.

Commenter's Statement: *"Given that groundwater mounding is said to not occur, then wastes must penetrate 20 feet in 3 days. (At least 6.7 ft/day). Thus to reach Shaw Run should take no more than the 2 years DNREC noted. However, groundwater will move through the path of least resistance, and as noted by Wang, McKenna, & DeLiberty with Delaware Geological Survey, there are significant groundwater discharge areas laterally adjacent to the planned RIB site such that dilution/attenuation would be minimal and not as reported by Tidewater."*

Department's Response: EGI evaluated groundwater mounding from RIB operation as part of its 2009 PGIA. The evaluation indicated that groundwater

mounding will occur at the site. In this case, it appears the commenter calculated an infiltration rate of 6.7 ft/day and used this rate as an indication of average linear velocity. Although the units of infiltration rate and hydraulic conductivity are the same as units of velocity (length/time), there are distinct differences between all three (see Department's Response above).

The commenter is accurate in stating that groundwater follows the path of least resistance. EGI evaluated the potential for groundwater mounding and resulting flow paths using the U.S. Geological Survey's numerical groundwater flow model, MODFLOW. The results of the modeling indicated >80% dilution along the shortest flow path and >90% within a 5-year time of travel and within 2,000 ft of RIB Area A. Flow from RIB Area A is semi-radial with the majority of flow to the east, southeast, and south with travel times ranging from 15 to 35 years.

Commenter's Statement: *"Tidewater claims that the treated waters dispersed through the RIBs will take 15-35 years to enter the Inland Bays. However Eastern Geoscience calculates that flow to Sarah Run, feeding Burton's Prong (as much as 10% of RIB deposition) will discharge into that body in more nearly 2 years and that soils may dilute as Tidewater claims, but that contact with surface water bodies may remain at the 5mg/l levels at which they exit the RIBs."*

Department's Response: The September 2009 PGIA prepared by EGI stated, "Most flows paths are very long; with travel times ranging 15 to 35 years prior to discharge to the down gradient streams and bays. On the west side of RIB Area A, approximately ten percent of the flow will follow a shorter path of approximately two years. This shorter path [to Sarah Run] does not develop until flows reach approximately 1.2 MGD." EGI went on to say, "Greater than 80 percent dilution is calculated along the shortest flow path and greater than 90 percent dilution is calculated with a five-year time of travel and within 2000 feet of RIB Area A."

Commenter's Statement: *Are all recommendations of the Natural Heritage Report (NHR) being complied with? The NHR at page 7 specifically requires the area of red maple-sweet gum swamp have an expanded buffer to minimize soil runoff and sedimentation, and at page 9 that the area of tuliptree forest with rare plants have the canopy remain intact and that soil disturbance and nutrient enrichment be avoided. Together these recommendations require that SPRAY AREA 7 as indicated for parcel 2-34-7.00-127.00 be REMOVED AND THE AREA LEFT UNDISTURBED.*

Department's Response: Tidewater's Plan to Comply with Recommendations of the Natural Heritage Programs Report dated November 29, 2010 states "No spraying is proposed in forested land" and the Department may consider permit conditions to provide further protection.

Commenter's Statement: *What treatment levels will be required? The facility proposed 5 mg/L TN and 0.5 mg/L TP. The 2008 average surface water discharge was 3.54 mg/L and 0.05 mg/L. Without additional treatment, the facility as proposed would greatly increase nutrient loads to streams that are already impaired. Will this facility be subject to best achievable treatment levels of 3.0 & 0.1?*

Department's Response: This facility will be required to comply with the Performance Standards established in the Inland Bays Pollution Control Strategy (PCS), which limits the annual average concentration to 5 mg/l for Total Nitrogen, and 3.9 mg/l for Total Phosphorus prior to discharge.

References

Strohmeier, Scott. Groundwater Protection Branch Memorandum to the Groundwater Discharges Section Environmental Scientist, Delaware Department of Natural Resources & Environmental Control, Dover, DE. 12 January 2010.

Eastern Geosciences, Inc., September 2009, Hydrogeologic Evaluation for Subsurface Wastewater Discharge Capacity for The Lands of Wandendale Farms, Inc., prepared for Tidewater Environmental Services, Inc., Dover, DE.

Fetter, C. W., Applied Hydrogeology. 4th ed. Upper Saddle River, NJ: Prentice Hall, 2001.

DNREC, Regulations Governing the Pollution Control Strategy for the Indian River, Rehoboth Bay and Little Assawoman Bay Watersheds, October, 2008.